4.0 Task IV – RFI Scope of Work

4.1 General Approach to Facility Characterization

The proposed scope of work for the initial phase of activities is designed to meet the following objectives: 1) characterize the potential exposure pathway associated with the industrial worker, and if necessary, determine a remedy to mitigate or control them; and 2) evaluate groundwater within the interior of the Facility and along the southern property boundary to determine the potential impact on human and ecological receptors associated with the Delaware River. The objectives of the proposed scope of work are based on the CFM which established that there are limited complete pathways/exposures for COPIs. The CFM is presented in Section 1.3.

The major factors that establish the CFM are as follows:

- The Facility is in a highly industrialized area that has witnessed heavy manufacturing, both chemical and petrochemical, since the turn of the century.

- Industrial operations predominantly occurred on the Facility and surrounding properties since the late 1800s that have resulted in a regional impact to groundwater quality within the area. Common contaminants associated with these sources or potential sources include VOCs, SVOCs, pesticides, and dissolved metals.

- The DNREC requires prior permission for the use of groundwater as a domestic water source and does not approve domestic use of groundwater in "franchise" areas – areas served by public water supplies. The groundwater in this area is presently not used as a public water supply nor does it function as a recharge area for any groundwater sources used for public water supply.

- Based on the land-use profile, potential human receptors to soil contamination at the Facility are limited to the industrial worker, and possibly construction workers. Possible exposures to current and future construction workers will be controlled by a Construction Management Plan and institutional controls. Potential exposure pathways to the industrial worker are dermal contact or ingestion of surficial soils and possibly inhalation of fugitive dusts and volatilized contaminants, based on the analytical data obtained. The scope of work is designed to characterize these potential pathways and, if necessary, determine a remedy to mitigate or control them.

- Groundwater beneath the Facility does not pose a risk to human health because there is no complete pathway. Groundwater from the Facility discharges into the Delaware River. The Delaware River is not used as a source of drinking water in the vicinity of the Facility. There is a potential for human consumption of surface water during recreational activities (i.e., boating) and consumption of organisms from the Delaware River. The scope of work addresses this potential pathway.

- There are no on-Facility ecological receptors at the Facility because there is no acceptable habitat. The only off-Facility ecological receptor is the Delaware River, which borders the

Facility to the south. Potential ecological impacts to the river are addressed in the work plan.

As such, soil and groundwater will be the media of highest concern and will be the focus of the RFI scope of work. Soil sampling will be performed to address the potential worker exposure pathway. Any impacts to off-Facility surface water and sediments in the river would be due to COPIs discharging with groundwater into the river. This migration pathway will be investigated by groundwater sampling, with emphasis placed on wells closest to the river. On-Facility surface water exists only as runoff and there are no on-Facility sediments. Surface water runoff is discharged to the Delaware River through NPDES outfalls, which is monitored by NPDES requirements.

4.2 Proposed Scope of Work

GCC will initiate a Facility investigation with two primary objectives. The first objective will be to evaluate the soil-to-industrial worker exposure pathway by characterizing surface soils at SWMUs that are not covered by a barrier that eliminates this pathway (i.e., asphalt or concrete). These activities will provide the necessary data required to determine whether any corrective action is appropriate for these areas.

Asphalt or concrete cover material will be considered engineering controls and details regarding the inspection, repair, and replacement of the materials will be included in the CMS for the site following the completion of the RFI. GCC has evaluated the current condition of the existing cover materials, where present, and has concluded the materials are functional and adequate, except as noted previously for SWMU 6.

The second objective will be to evaluate the groundwater quality in the uppermost water-bearing zone to assess whether it poses (or will pose) an unacceptable risk to human health (i.e., recreational) or ecological receptors of the Delaware River. Groundwater conditions will also be characterized at various locations across the Facility to evaluate Facility-wide conditions. The scope of work for the soil and groundwater investigations was developed based on a review of existing groundwater information, Facility conditions, and an understanding of Facility processes and SWMU locations. All work associated with the RFI will be performed in accordance with the DCQAP (Attachment A) and the Health and Safety Plan (Attachment B). Where possible, RFI Work Plan activities will be photodocumented.

4.2.1 Soil Characterization

4.2.1.1 Program Overview

Table 4-1 provides the rationale for conducting or not conducting soil sampling and analysis. Surface soil sampling will be performed at eight SWMUs and three AOCs where surface soils are currently uncovered. These SWMUs and AOCs include:

- SWMU 1 – Phosphoric Acid Storage Pond (North Pond)
- SWMU 16 – Past Landfill–Area IV
- SWMU 21 – Past Landfill–Area IX
- SWMU 22 – Past Landfill–Area X
- SWMU 23 – Past Landfill–Area XI
- SWMU 27 – EPS–North
- SWMU 28 – Hypo Muds Accumulation
- SWMU 30 – East and West Lagoons
- AOC 1 – Tank 15 Spill Area
- AOC 3 – Pesticide Investigation/Remediation Areas
- AOC 4 - Conrail Fuel Spill Area

Table 4-2 presents a summary of the scope of work and the corresponding data objective for each SWMU/AOC. As shown in Tables 4-1 and 4-2, there are two additional SWMUs (SWMU 5 – Spar Building Storage Area and SWMU 10 – South Waste Treatment Storage Pad) where soil samples may be collected depending on whether an inspection confirms the existence of an asphalt or concrete cap/cover. In addition, there are two SWMUs (SWMU 3 – Red Mud Slurry Pond A and SWMU 6 – Drum Storage, South Treatment Plant) that will not be sampled but asphalted due to the limited amount of exposed surface areas.

A total of 47 soil samples will be collected and submitted for chemical analysis from the eight SWMUs and three AOCs. Soil samples will be submitted for laboratory analysis for the COPIs indicated in Table 4-2. Metals and pH are the COPIs for most samples obtained within the South Plant area. Samples from the North Plant parcels will be analyzed for a broader range of COPIs. The COPIs were selected based on the knowledge of the types of waste managed in the SWMUs and AOCs. A summary of soil sampling parameters, analytical methods, and quality assurance samples is provided in Table 4-3.

4.2.1.2 Soil Sampling and Analysis

4.2.1.2.1 SWMU 1 – Phosphoric Acid Storage Pond (North Pond)

During operation, the pond managed phosphoric acid and wastewater (primarily sodium hydroxide). The pond was backfilled with clean fill in 1985 and currently is covered with limestone gravel. Two surface soil samples (identified as B1-A and B1-B) will be collected from the former phosphoric acid storage pond to evaluate the soil-to-industrial worker exposure pathway. One soil sample will be collected to represent the northern portion of the former pond and one soil sample will be collected to represent the southern portion of the former pond. Approximate soil sample locations are presented in Figure 6. The soil samples will be collected from the 0- to 6-inch depth interval immediately beneath the gravel cover and analyzed for Appendix IX metals and pH. As stated in Section 1.4.1, the North Pond received wastes from only acid-based processes and, therefore, the analytical program will sufficiently characterize potential risk associated with this SWMU.

4.2.1.2.2 SWMU 3 – Red Mud Slurry Pond A

During operation, the pond stored iron oxide. Upon closure in 1974, it was backfilled with clean fill. Based on available documentation, Facility inspections, and interviews, the former location of the Red Mud Slurry Pond A is covered with asphalt. During the RFI, GCC will confirm whether the asphalt cover extends beyond the westernmost edge of the pond using aerial photographs (Appendix K) and detailed Facility plans. Since the potentially uncovered area is relatively small, if is it determined that a portion of the pond is not covered with asphalt, the small area will be asphalted during the implementation of the RFI.

4.2.1.2.3 SWMU 5 – Spar Building Storage Area

The former Spar Building Storage Area stored a variety of nonhazardous wastes including hypo muds, resins, acid sludges, waste oils, and lubricants. Reportedly, the storage area was covered with asphalt. In February 2002, it was observed that plant construction debris and fill were spread over the area and the entire former Spar Building Storage Area was covered with the debris and topped with gravel. Therefore, during Facility inspections, it was not possible to determine whether the asphalt cover is in place. During the RFI, GCC will confirm the location and integrity of the asphalt. A backhoe will be used to displace existing debris. If the asphalt cover is no longer in place, or is severely deteriorated such that worker exposure to underlying soils is possible in the future, the storage area will be divided into quadrants and four soil samples (identified as B5-A through B5-D) will be collected and submitted for chemical analysis to evaluate the industrial worker exposure pathway. The soil samples will be collected from the 0- to 6-

inch depth interval from the original ground surface and analyzed for Appendix IX metals, VOCs, SVOCs, and pH.

4.2.1.2.4 SWMU 6 – Drum Storage, South Treatment Plant

The Drum Storage, South Treatment Plant was used to store off-grade nonhazardous sodium sulfite/sodium sulfate product. The storage area had a capacity to store up to 700 55-gallon drums. The Drum Storage, South Treatment Plant was in operation from 1980 to 1989. The storage area had dimensions of approximately 5,250 square feet. The RFA indicates the entire area was paved with concrete or asphalt. The concrete portion measures approximately 28 feet by 25 feet and the asphalt portion measures approximately 70 feet by 65 feet. The RFA does not indicate, and GCC cannot confirm, whether the storage area was paved during its entire period of use. During a site walk in February 2002, the pavement in two areas was observed to be highly deteriorated. There are no documented releases associated with the Drum Storage, South Treatment Plant. In 1989, approximately 600 55-gallon drums of material were removed and sent to an off-site landfill. There were no drums or other material storage units observed at the SWMU during the February 2002 site walk.

During the RFI, GCC will determine whether there is exposed soil in the two paved areas that are deteriorated. Since the potentially uncovered area is relatively small, if is it determined that a portion of the area is not paved, the unpaved area will be asphalted during the implementation of the RFI.

4.2.1.2.5 SWMU 10 – South Waste Treatment Storage Pad

The South Waste Treatment Storage Pad housed lined dumpsters that stored nonhazardous waste treatment muds. There are no documented releases associated with the SWMU. The area is currently covered with limestone gravel but reportedly there is a concrete pad underneath. During the RFI, the existence of the concrete pad will be confirmed by removing the overlying gravel at several locations. If the concrete is no longer in place, or is severely deteriorated such that worker exposure to underlying soils is possible, the storage pad will be divided into quadrants and four soil samples (identified as B10-A through B10-D) will be collected and submitted for chemical analysis to evaluate the soil-to-industrial worker exposure pathway. The soil samples will be collected from the 0- to 6-inch depth interval beneath the gravel cover and analyzed for Appendix IX metals and pH. According to interviews with facility personnel, the waste treatment muds consisted of calcium sulfate from the neutralization of slightly acidic residue from the nearby alum plant. The waste treatment muds may include trace amounts of heavy metals. Therefore, the proposed analytical program of metals and pH is adequate for determining environmental risks associated with this SWMU.

4.2.1.2.6 SWMU 16 – Past Landfill-Area IV

The Past Landfill-Area IV consists of two excavations, each measuring approximately 10 feet long, 8 feet wide, and 6 feet deep. Reportedly, waste solvents generated during packaging operations were disposed in the landfills between 1972 and 1977. In 1977, they were backfilled with crushed stone. The surface soils within and adjacent to the SWMU are currently uncovered. It was not possible to confirm the exact extent of SWMU 16 during review of aerial photographs, interviews with employees, and/or field inspections. Therefore, the objectives of the soil sampling program at SWMU 16 will be to characterize the soil-to-industrial worker exposure pathway within and adjacent to the anticipated SWMU area, and confirm the location and lateral extent of the landfills.

Initially, test pits will be excavated to a depth of 4 feet bgs to confirm the location and extent of landfill materials. Based on the dimensions of the landfills, excavating to a depth of 4 feet should be sufficient to determine the lateral extent of the SWMU for the purpose of accurately locating its extent on a site drawing by a licensed surveyor. The test pits will progress perpendicular to the anticipated landfill boundary, starting from a point outside the anticipated boundary. If waste is not found as the anticipated boundary is passed, the depth of the test pit will be increased to a maximum depth of 6 feet to locate the edge of waste.

To characterize the soil-to-industrial worker exposure pathway, surface soil samples will be collected from the interior of the SWMU and from the edges of the landfills, which will be physically determined by test pits. A total of nine soil samples (identified as B16-A through B16-I) will be collected and chemically analyzed to evaluate the soil-to-industrial worker exposure pathway. The approximate soil sample and test pit locations are presented in Figure 7. One soil sample will be collected from within each of the landfills and seven soil samples will be collected from just beyond the edges of the landfill areas. At the landfill edges, the surface soil samples will be taken from the walls of the test pits. To ensure that undisturbed soil samples are obtained, a 2- to 4-inch layer of soil will be scrapped from the top 6 inches of the test pit wall prior to collecting the sample from the designated location. All soil samples will then be collected from the 0- to 6-inch depth interval. The soil samples will be analyzed for Appendix IX VOCs, SVOCs, organo-chlorine pesticides, organo-phosphorus pesticides, herbicides, metals, cyanide, and pH.

4.2.1.2.7 SWMU 21 – Past Landfill-Area-IX, SWMU 22 – Past Landfill-Area X, and SWMU 30 – East and West Lagoons

Past Landfill-Area IX (SWMU 21) reportedly accepted pesticide residue wastes. It was briefly used around 1960 and consisted of two side-by-side excavated areas measuring approximately 200 feet long, 9 feet wide, and 6 feet deep. It was backfilled in 1960 and one portion is currently covered with crushed stone and the other portion is covered by asphalt. Past Landfill Area-X (SWMU 22) reportedly accepted selenium residue wastes. It was briefly used around 1958-1959 and consisted of an excavated area measuring approximately 200 feet long, 50 feet wide, and 10 feet deep. It was backfilled and is currently covered with crushed stone. The East and West Lagoons (SWMU 30) were used between 1972 and 1997 to manage process wastewater associated with the North Plant. Reportedly, portions of the lagoons were constructed on and/or within parts of SWMUs 21 and/or SWMU 22. The area is currently soil or gravel covered, except for the northern portion of SWMU 21 which is asphalt covered.

As presented in Section 1.5.1, pesticides were detected in soils immediately adjacent to the East and West Lagoons and in groundwater beneath the lagoons. Pesticides detected immediately adjacent to the lagoons were not limited to soils located within SWMUs 21 and 22 but around the entire perimeter of the lagoons. This suggests that during construction of the lagoons, materials associated with the former landfills were disturbed and redistributed over a larger area. Therefore, while the historical locations of SWMUs 21 and 22 are relatively certain, the redistribution of the materials associated with them is less certain. The soil investigation for Past Landfill-Area IX, Past Landfill-Area X, and East and West Lagoons will focus on evaluating the soil-to-industrial worker exposure pathway and confirming the lateral extent of the pesticide-impacted surface soils throughout the area.

A total of 11 surface soil samples (identified as B21-A through B21-K) will be collected adjacent to these SWMU areas. Soil samples will not be collected from the interior of SWMU 30 since the East and West Lagoons were recently closed and backfilled with clean fill. In addition, surface soil samples were collected at well locations (EW series wells) in the interior portions of SWMUs 21 and 22 during lagoon closure activities. Therefore, the data from these samples will be used to assess risk in those areas. The surface soil sample locations are presented in Figure 8. As shown in Figure 8, proposed soil sample locations were placed at approximately 100-foot centers beyond the historical soil sample locations (EWL-6 through EWL-9) and this group of SWMUs. At each sampling location, soil samples will be collected from the 0- to 6-inch interval beneath the existing gravel cover or asphalt and analyzed for Appendix IX VOCs, SVOCs, organo-chlorine pesticides, organo-phosphorus pesticides, herbicides, metals, cyanide, and pH. The analytical program is consistent with the analytical program used for

groundwater analysis during implementation of the DNREC-approved closure of the lagoons. Soil samples will be collected using hand tools (i.e., hand auger, trowel), possibly assisted by a small backhoe. In the event a backhoe is used, the surface soil samples will be taken from the excavation in the same manner, as described previously for test pits (Section 2.1.2.6).

4.2.1.2.8 SWMU 23 – Past Landfill-Area XI

The Past Landfill-Area XI consisted of a small excavation measuring approximately 10 feet long, 4 feet wide, and 1 foot deep. The landfill was reportedly used to dispose of developmental laboratory wastes. The surface soils associated with the SWMU are currently uncovered. The exact location of this SWMU is not completely known. The objectives of the soil sampling program will be to characterize the soil-to-industrial worker exposure pathway within and adjacent to the landfill and confirm the location and lateral extent of the landfill.

Initially, test pits will be excavated to a depth of 4 feet to confirm the location and lateral extent of landfill materials. Based on the dimensions at the landfill, excavating to a depth of 4 feet should be sufficient to determine the lateral extent of the SWMU for the purpose of accurately locating its extent on a site drawing by a licensed surveyor. The test pits will progress perpendicular to the anticipated landfill boundary, starting from a point outside the anticipated boundary. If waste is not found as the anticipated boundary is passed, the depth of the test pit will be increased to a maximum depth at 6 feet to locate the edge of waste.

To characterize the soil-to-industrial worker exposure pathway, surface soil samples will be collected from the interior of the SWMUs and from the edges of the landfills, which will be physically determined by test pits. A total of five soil samples (identified as B23-A through B23-E) will be collected and chemically analyzed. The soil sample locations are presented in Figure 9. One soil sample will be collected from within the landfill and four soil samples will be collected immediately adjacent to the landfill. All soil samples will be collected from the 0- to 6-inch depth interval beneath the existing gravel cover to evaluate the soil-to-industrial worker exposure pathway. The soil samples will be analyzed for Appendix IX VOCs, SVOCs, organo-chlorine pesticides, organo-phosphorus pesticides, herbicides, metals, cyanide, and pH.

At the landfill edges, the surface soil samples will be taken from the walls of the test pits. To ensure that undisturbed soil samples are obtained, a 2- to 4-inch layer of soil will be scrapped from the top 6 inches

of the test pit wall prior to collecting the sample from the designated location. All soil samples will then be collected from the 0- to 6-inch depth interval.

4.2.1.2.9 SWMU 27 – EPS–North

Beginning in 1972, the EPS–North processed sanitary wastewaters that were associated with North Plant operations. Process wastewater entering the system is collected in the two in-ground storage tanks. From 1972 to 1997, wastewater was stored in lined basins designated the East and West Lagoons (SWMU 30) prior to entering the treatment Facility. As discussed in Section 1.4.21, these lagoons have since been closed. From the in-ground storage tanks, process wastewater is introduced in a controlled manner to neutralizers, where calcium hydroxide is added primarily for pH control and fluoride precipitation. Materials within the neutralizers are then conveyed to clarifiers, where precipitates are settled out. The overflow from the clarifiers is discharged to NCC's POTW and the clarifier bottoms are sent to a filter press for solids removal. Filtrate from the filter press is returned to the clarifiers and the solids are collected and sent off Facility for disposal. The solids are nonhazardous and are essentially calcium fluoride, with trace metals. Typically, approximately 75,000 pounds of solid waste were generated each month. There are no documented releases associated with the EPS-North.

During a February 2002 inspection of the Facility, it was observed that the ground surface around the three aboveground neutralization tanks and the two clarifier tanks is covered with gravel. A total of five surface soil samples (identified as B27-1 through B27-5) will be collected and analyzed from SWMU 27. One surface soil samples will be collected from around the base of each of the five aboveground tanks. The objective of the soil sampling program will be to characterize the soil-to-industrial worker exposure pathway adjacent to the aboveground tanks. Approximate soil sample locations are presented in Figure 10. The soil samples will be collected from the 0- to 6-inch depth interval immediately beneath the gravel cover and analyzed for Appendix IX VOCs, SVOCs, organo-chlorine pesticides, organo-phosphorus pesticides, herbicides, metals, cyanide, and pH. Soil samples will be collected with hand tools (i.e., hand auger, trowel).

4.2.1.2.10 SWMU 28 – Hypo Muds Accumulation

Hypo muds (ammonium thiosulfate) are accumulated in a lined dumpster at two locations on the northeastern portion of the South Plant. Hypo muds have been accumulated in dumpsters since 1973. The waste is generated by wastewaters from photo-salt manufacturing processes being oxidized and the suspended solids are removed by vacuum filtration.

During a February 2002 inspection of the Facility, it was observed that the ground surface at the two areas is uncovered. A total of six surface soil samples (identified as B28-1 through B28-6) will be collected and analyzed from the SWMU. Three surface soil samples will be collected from each of the two areas. The objective of the soil sampling program will be to characterize the soil-to-industrial worker exposure pathway. Approximate soil sample locations are presented in Figure 11. The soil samples will be collected from the 0- to -6-inch depth interval immediately beneath the gravel cover and analyzed for Appendix IX metals and pH. Soil samples will be collected with hand tools (i.e., hand auger, trowel).

4.2.1.2.11 AOC 1 – Tank 15 Spill Area

In September 1996, an approximate 1,500-ton spill of sulfuric acid occurred from Tank 15. Tank 15 is located on the west central portion of the South Plant of the Facility. Tank 15 is surrounded by a concrete secondary containment wall and the spill was primarily contained within this structure. Approximately 20 gallons of acid had leaked from the containment wall onto the surrounding ground surface.

Two surface soil samples (identified as BT15-1 and BT15-2) will be collected from the Tank 15 Spill Area outside the containment wall. No soil sampling will be conducted on the earthen floor inside the approximately 12-foot-high containment wall since the area is not accessible to the industrial worker and, therefore, does not pose an environmental risk. The objective of the soil sampling program will be to characterize the soil-to-industrial worker exposure pathway outside the containment area. Soil sample locations will be biased to areas of surface soil staining or other visual evidence of impact. Approximate soil sample locations are presented in Figure 12. The soil samples will be collected from the 0- to 6-inch depth interval immediately beneath the gravel cover and analyzed for Appendix IX metals and pH. Soil samples will be collected with hand tools (i.e., hand auger, trowel).

4.2.1.2.12 AOC 3 – Pesticide Investigation/Remediation Areas (North Plant)

In 1976, Allied Chemical Corporation began investigations into the potential impact of pesticides on their B & A Works Facility, now called the North Plant. Pesticides were manufactured at the B & A Works at that time. Environmental media investigated included surface soils and associated storm water runoff, sediment, and surface water. Remedial actions were performed which included a Facility-wide paving program to eliminate potential exposures of the pesticide-impacted surface soils to the industrial worker and to minimize the potential migration of the pesticides during precipitation events. The extent of the surface soil sampling activities are presented in Figure 3 and soil sample results are contained in Tables 1-8, 1-9, and 1-10. Figure 3 also shows the reported extent of paving on the Facility.

RFI activities will consist initially of an inspection of the ground cover on GCC property at the North Plant. Where necessary, soil sampling and analysis will be completed to evaluate the soil-to-industrial worker exposure pathway. Soil sampling and analysis will be performed at locations that are known to be uncovered (i.e., grass and dirt) and are in the proximity of the former soil sample locations that exhibited relatively high concentrations of pesticides. A total of seven surface soil samples (identified as BPA-A through BPA-G) will be collected from the 0- to 6-inch depth interval within two areas on the Facility and the adjacent property. The proposed RFI soil sample locations are presented in Figure 3. As shown in Figure 3, the soil samples will be collected from two distinct areas. Five surface soil samples will be collected and analyzed from the north central portion of the Facility and adjacent property north of Building 23 (see Figure 3). Of the five samples, two samples will be collected from the grassy area within the Facility and three soil samples will be collected immediately beyond the Facility to the north after obtaining approval from the adjacent property owner. The soil samples will be collected north of the Facility since access to that area is not restricted and the area is not paved. The second area is located on the eastern edge of the North Plant and east of Building 19. Two surface soil samples will be collected from a grass and dirt area. The soil samples will be analyzed for Appendix IX organo-chlorine pesticides, organo-phosphorus pesticides, and herbicides. Soil samples will be collected using hand tools (i.e., hand auger, trowel).

As part of the RFI work scope, the paved surface condition of the Facility on the North Plant will be assessed and documented in areas of historical soil sampling and analysis to determine whether additional soil sampling and analysis is warranted.

4.2.1.2.13 AOC 4 – Conrail Fuel Spill Area

In the late 1970s, the fuel cell of a Conrail tank car was punctured which resulted in the release of several hundred gallons of diesel fuel along the rail line immediately east of the Spar Building Storage Area (SWMU 5). According to GCC personnel, the spill was remediated by Conrail under the oversight of the DNREC. The approximate area of this spill is identified in figure 2. The area is currently dirt covered.

Two surface soil samples (identified as BCF-1 and BCF-2) will be collected from the Conrail Fuel Spill Area. The objective of the soil sampling program will be to characterize the soil-to-industrial worker exposure pathway. Soil sample locations will be biased to areas of surface soil staining, stressed vegetation, or other visual evidence of impact. Approximate soil sample locations are presented in Figure 13. The soil samples will be collected from the 0- to 6-inch depth interval immediately beneath

the gravel cover and analyzed for Appendix IX VOCs and SVOCs. Soil samples will be collected with hand tools (hand auger, trowel).

4.2.1.3 Soil Sampling Methods

Only surface soil samples (0- to 6-inch depth interval) will be collected during the RFI for chemical analyses. Surface soil samples will be collected using hand tools, (i.e., hand auger, trowel) possibly assisted by a small backhoe. Although to some extent, particular soil sampling methods will depend on the type of material encountered. Soil samples will be field screened with an organic vapor analyzer and will be physically described using the American Society for Testing and Materials (ASTM) classification of the soils. The ASTM information will be logged and available for Department review. Detailed field logs will be kept throughout the sampling program. All soil samples collected for VOC analysis will be grab samples collected using the Encore sampler. Any nondedicated sampling equipment will be decontaminated prior to the initiation of any sampling activities and between sampling locations.

At SWMUs 16 and 23, where test pits will be used to confirm the lateral extent of the landfills, surface soil samples will be taken from the walls of the test pits just outside the identified edge of the landfill. To ensure that undisturbed soil samples are obtained, a 2- to 4-inch layer of soil will be scrapped from the top 6 inches of the test pit wall prior to collecting the sample from the designated location. All soil samples will then be collected from the 0- to 6-inch depth interval.

4.2.2 Groundwater Characterization

4.2.2.1 Program Overview

The primary objective for groundwater characterization is to evaluate water quality within the uppermost water-bearing zone to assess whether it currently poses (or will pose in the future) an unacceptable risk to human health (i.e., recreational) or ecological receptors of the Delaware River. A total of 32 monitoring wells (15 existing and 17 new) have been included in the proposed groundwater monitoring program. The new monitoring wells are designated as MW-1 through MW-17. The existing monitoring wells include: B-1, B-2, B-2D, B-3, B-4, B-5, B-5D, SAL-1, SAL-3, SAL-4, EWL-5, EWL-6, EWL-7, EWL-8, and EWL-9. All newly installed wells will be screened in the uppermost water-bearing zone. Existing boring logs and monitoring wells from the Facility suggest the depth of the wells will average approximately 15 to 20 feet bgs. If necessary, deeper zone(s) of saturation may be further investigated in later phases of the RFI to delineate the vertical extent of contamination. However, the necessity for and

location of deeper wells will be determined by the results of the initial phase of groundwater characterization.

Each existing and proposed monitoring well will provide information to meet the primary groundwater characterization objective. The four types of data that will be gathered from the monitoring well system to meet this objective will include:

- Depth-to-groundwater levels to determine groundwater flow conditions across the facility.
- Groundwater quality at the facility perimeter at anticipated hydraulically upgradient locations to determine possible off-site influences on water quality beneath the facility.
- Groundwater quality at the facility perimeter at anticipated hydraulically downgradient locations to evaluate current potential risk to human health or ecological receptors of the Delaware River.
- Groundwater quality at interior facility locations to evaluate future groundwater quality conditions at site perimeter wells.

Table 4-4 provides a summary of the existing and proposed groundwater monitoring locations, anticipated objective of the well, and general comments regarding its location relative to SWMUs/AOCs. Individual monitoring wells may perform more than one function, in relation to the types of data listed above. The interpretation of the data received regarding groundwater quality and flow condition will ultimately determine how a particular monitoring well is evaluated. A summary of anticipated uses of the monitoring well network are summarized in the following paragraphs.

All 32 monitoring wells will be used to obtain groundwater flow conditions across the facility. Of the 32 monitoring wells included in the program, 24 monitoring wells (seven existing and 17 new) will be used to determine groundwater quality and groundwater flow conditions across the Facility. The remaining eight monitoring wells are existing wells from previous investigations at the Facility that will be used to obtain additional information on groundwater flow conditions. However, historical groundwater quality from these eight wells will be used in the evaluation of the RFI characterization activities. GCC also intends to obtain data from four additional wells proposed by Honeywell within the North Plant and any groundwater data obtained from Honeywell studies associated with SWMU 9, along the Delaware River. The proposed RFI well locations, including the proposed Honeywell wells, are presented in Figure 14. A summary of existing monitoring well installation details and status are provided in Table 1-4.

Monitoring Wells MW-4, MW-13, and possibly MW-1 are intended to provide data regarding possible impacts on groundwater quality from off-site sources. The four Honeywell wells located on the North Plant will also be used in supporting this data use.

Monitoring Wells MW-2, MW-12, MW-5, MW-15, MW-7, MW-11, MW-10, MW-9, MW-8, B-2, and B-2D are intended to characterize groundwater at the site perimeter. Data gathered from these wells will be used to evaluate potential risks to off-site human and ecological receptors of the Delaware River.

Monitoring Wells MW-17, MW-3, MW-16, MW-6, and MW-14 are located within the interior portion of the facility and are intended to provide information that will assist in evaluating future groundwater quality conditions at site perimeter wells. In turn, this information will be used to evaluate the future risk to receptors of the Delaware River.

This monitoring well network was designed to meet the primary objective, as well as ensure adequate hydraulic downgradient coverage for SWMUs and AOCs identified at the site. For example, MW-17, MW-1, and the two proposed Honeywell wells located along the Pennsylvania - Delaware State Line will be used to evaluate groundwater conditions anticipated to be downgradient from SWMUs located in the eastern portion of the North Plant. In a similar manner, MW-2, MW-3, MW-12, and MW-16 will be used to evaluate possible impacts to groundwater from SWMUs located in the western portion of the North Plant. Wells MW-7, MW-14, and MW-15 will provide data to evaluate conditions anticipated to be downgradient of SWMUs in the westcentral portion of the South Plant and Wells B-1, B-2, B-2D, B-3, B-4, B-5, B-5D, MW-8, MW-9, and MW-10 will evaluate potential impacts from AOC 2 and SWMUs in the southern portion of the South Plant. It should be noted that Wells B-1, B-3, B-4, B-5, and B-5D will be sampled primarily for the purpose of evaluating current water quality conditions associated with the former Acid Spill Area (AOC 2) and, therefore, the samples will be analyzed for a limited list of parameters as stated in Table 4-5.

Two rounds of groundwater sampling and analysis will be performed. The analytical programs for groundwater are presented in Table 4-5. The data from the two rounds of sampling will be reviewed along with the existing data to determine whether additional groundwater sampling is necessary to meet the objectives of this RFI scope of work. If groundwater quality results from the two sampling events indicate that there is not a current or potential future impact to the Delaware River, then additional sampling will not be performed as part of RFI activities. A "longer term" monitoring program will be developed as part of the CMS to confirm conditions identified during the RFI and evaluate future

potential risks. This initial phase of groundwater characterization will provide the necessary information to evaluate whether the primary objective has been met and confirm the Facility conceptual model.

4.2.2.2 Drilling Methods

Boreholes will be advanced at each location using 8-1/4-inch outside-diameter continuous-flight hollow-stem augers. If fill material is encountered that the augers cannot penetrate or excessive heaving of sands into the augers occurs which cannot be controlled, the augers will be filled with drilling mud or the wash rotary method of drilling will be employed.

Continuous split-spoon samples will be collected throughout the length of each borehole to characterize physical and stratigraphic conditions with depth. Soil samples will be field screened with an organic vapor analyzer. Immediately following the opening of the spilt spoon, readings of the soil will be obtained along the length of the sample. The intake of the instrument will be held in close proximity to the sample. The highest reading for each sample will be recorded on the boring log. The soil samples will also be physically described using the ASTM classification scheme. Detailed field logs will be kept throughout the drilling activities. One soil sample will be collected from each boring at the water table and analyzed for soil organic content. This information may be necessary in the future if contaminant migration rates need to be calculated across the Facility.

Downhole equipment will be decontaminated prior to the initiation of any drilling activities and between drilling locations. Soil cuttings will be containerized in Department of Transportation 55-gallon drums. Each of the drums will be labeled (contents and drilling location) and staged in a secure location on the Facility for disposition following characterization. (See Section 4.6 for further information on the handling of Investigation Derived Wastes.) GCC may segregate the cuttings from above and below the water table, depending upon field conditions.

4.2.2.3 Monitoring Well Construction

All monitoring wells will be constructed of 2-inch inside-diameter, flush-joint, and threaded Schedule 40 polyvinylchloride well screen and riser. A typical monitoring well installation detail is presented in Figure 15. The screen interval of each well will be 10 feet in length, have a slot size of 0.010 inch, and straddle the water table. As the screened section is lowered through the augers and into the borehole, an appropriate length of riser pipe will be added to case the well to an elevation of a few inches below the ground surface. As the augers are removed from the borehole, a formation stabilizer consisting of medium to coarse silica sand will be placed in the annular space surrounding the well screen. The

sandpack will extend to approximately 2 feet above the well screen. An approximate 1-foot thick fine sand filter pack will be placed on top of the stabilizing sand and about 2 feet of pelletized bentonite seal will be placed over the fine sand. The bentonite pellets will be allowed to hydrate for a minimum of 1 hour before the remainder of the annular space from the top of the bentonite to approximately 2 feet below grade is sealed with a cement/bentonite grout mixture. Likely modifications to well construction above the screened interval may include reducing the thickness of the sand filters and bentonite, if field conditions indicate the top of the groundwater table is relatively close (within 4 feet) to the ground surface. The groundwater table near the river may be tidally influenced and, therefore, fluctuate more than at other portions of the facility. The wells will be completed flush with the ground surface using a stainless steel protective casing. GCC will install a concrete pad around each of the new wells. A lock will be placed on the well cap to ensure the integrity of the well. A reference point will be established on the top of each well casing for water level measurements.

4.2.2.4 Well Development

Following completion of the well installation, all newly installed wells will be developed no sooner than 24 hours after completion to improve well efficiency and remove any foreign material introduced during drilling and to ensure that representative groundwater samples are obtained. Development will be accomplished by either pumping, surge blocking, bailing, or a combination of these methods. 10 NTUs will be considered the criterion for successful well development. In the event 10 NTUs is not achieved after removing 10 well volumes, the well will be considered developed.

To assess sediment buildup in existing wells that are sampled, the depth of each well will be measured in the field and compared to the installation details for that well. If sediment build up is greater than 10 percent of the screened length, then the well will be redeveloped prior to purging. The well will be considered redeveloped consistent with the method described above.

Field measurements of temperature, conductivity, and pH will be measured throughout well development. Water removed will be collected in drums or a tank for disposition following characterization. The well development water will be containerized and characterized, as necessary. The disposition of the purge water will depend upon its quality. It may be discharged to the ground surface, the plant wastewater treatment system, or through the NPDES outfall location, as allowed. USEPA approval will be obtained prior to final disposition.

4.2.2.5 Groundwater Sampling and Analysis

Two rounds of sampling will be conducted for the monitoring well network to characterize groundwater quality. The first round will take place approximately 2 weeks following well development. The second round will be conducted as confirmation for the initial sampling results and to account for potential seasonal changes in water quality. Therefore, the amount of time between the two sampling events will depend on when the RFI activities are initiated. GCC will obtain concurrence with the USEPA prior to implementing the second round of sampling.

Prior to groundwater purging and sampling of the monitoring wells, the depth to water in each well will be measured to the nearest 0.01 foot, sounded, and the volume of water contained within the well casing calculated. Water level measurements from each well will be obtained prior to sampling. Additionally, all wells will be checked for the presence of light or dense nonaqueous phase liquids. These measurements will be conducted using an oil/water interface probe.

Low-flow purging and sampling will be utilized to collect groundwater samples. Low-flow purging focuses on pumping a monitoring well from the well's screen interval at a flow rate that is less than the recharge capacity of the formation. The rate of pumping is generally specific to the water-bearing unit, but typically does not exceed 1 liter per minute (or equivalently, 0.26 gallon per minute). By purging at low-flow rates, only groundwater that enters through the well screen is purged from the well. Because stagnant water located above the pump intake is not drawn down into the pump, the casing volume would not have to be purged from the well prior to sampling.

All equipment will be laid on clean plastic sheeting placed around or beside the well. The pump or tubing connected to a peristaltic pump will be set with the intake at the midpoint of the of the "wetted portion" of the screened interval, preferably in advance of the sampling event at the well.

Upon initiation of pumping, the flow rate will be measured using an appropriate graduated container, preferably 1 liter or 1 quart. The flow rate will be adjusted to approximately 1 liter per minute. The water level will be checked periodically as a guide to flow rate adjustment.

An in-line water quality measurement device will be used to continuously monitor groundwater quality indicator parameters. The water quality indicator parameters will include pH, redox potential, specific conductance, dissolved oxygen (DO), and turbidity. Measurements will be taken every 3 to 5 minutes. Stabilization will be considered achieved when three successive readings are within 10 percent for pH,

conductivity, redox potential, and DO. Stability is demonstrated when turbidity measurements are less than 10 NTU and vary less than 1 NTU over three successive measurements.

Upon parameter stabilization, sampling will be initiated. If an in-line device is used to monitor water quality parameters, it will be disconnected or bypassed during sample collection. Sampling flow rate may remain at the established purge rate or may be altered to minimize aeration, bubble formation, turbulence in sample bottles, or loss of volatile constituents due to extended residence time in tubing. Typically, flow rates less than 0.5 liter per minute are appropriate. The flow rate during groundwater sampling will be adjusted to minimize (less than 0.2 foot) drawdown. The same device will be used for sampling as was used for purging. Groundwater sampling will proceed by collecting groundwater samples directly in appropriate containers, and preserving the samples, as necessary.

Samples will be field tested at the wellhead for pH, Eh, DO, turbidity, specific conductance, and temperature. Groundwater samples will be collected and submitted for laboratory analyses for Appendix IX metals, total cyanide, organo-chlorine pesticides, chlorinated herbicides, organo-phosphorus pesticides, VOCs, and SVOCs. Groundwater samples for metals will not be field filtered prior to preservation. A summary of the parameters to be analyzed, analytical methods, and QA samples are presented in Table 4-5.

The purge water will be containerized and characterized, if necessary. The disposition of the purge water will depend upon its quality. Depending upon its quality, it may be discharged to the ground surface, the plant wastewater treatment system, or the NPDES outfall location, as allowed.

4.2.2.6 Groundwater Elevation Measurements

Following groundwater development activities, and after a suitable period to allow for water level stabilization (1 week), water levels will be obtained from each of the 32 newly installed and existing groundwater monitoring wells. Groundwater level measurements from all the facility wells will be collected within as short a time period as possible to obtain an accurate depiction of the water table. The water level measurements will be obtained using a M-Scope with a calibrated rope to 0.01 foot. The water levels will be obtained from a marked location on the well casing designated by a surveyor.

4.3 Surveying

A licensed surveyor will survey the locations of all groundwater monitoring wells, soil borings, and test pits. All sampling points other than the wells will be staked and labeled by Earth Sciences to provide

proper guidance for the subcontractor. The horizontal and vertical position of each location will be referenced to USGS coordinates. The ground surface elevation and location of each of the soil sampling locations as well as the ground surface elevation, reference point elevation, and location of the monitoring wells will be determined. Elevations will be determined with respect to mean sea level and to an accuracy of 0.01 foot.

4.4 Additional RFI Activities

It is possible that, following the implementation of the proposed RFI activities, additional characterization activities will be necessary to meet the objectives. If data gaps are identified, an additional RFI scope of work will be prepared and submitted to the USEPA for review and approval prior to submitting the draft RFI report.

4.5 Stabilization/Remedial Measures

At present, there are no available data indicating that stabilization/remedial measures are necessary. Decisions regarding future measures will be made based on an evaluation of corrective measures necessary for the elimination/control of exposure pathways, as required.

4.6 Management of Investigation Derived Wastes

Wastes generated from investigation activities are expected to include disposable personal protective equipment, soils and groundwater from groundwater well installation and sampling, and decontamination fluids accumulated during the cleaning of nondedicated sampling equipment. Disposable personal protective equipment equipment, soils and groundwater, and decontamination fluids will be segregated and staged separately in approved 55-gallon drums or larger storage vessels. The drums will then be staged on site in a designated area and their materials characterized for appropriate disposal.

4.7 Project Schedule

The schedule to perform the tasks described in this RFI Work Plan is presented in Figure 16. It is estimated that it will require approximately 12 months to conduct the investigation and complete the report following the USEPA's approval of the RFI Work Plan. The duration of field activities is reasonable-case estimates, and do not take into account any unforeseen delays.

Following the USEPA's Work Plan review and approval, preliminary activities such as subcontractor selection, mobilization, and coordination with the analytical laboratory are expected to be completed within 3 weeks. The schedule assumes that the selected drilling firm will have a drilling crew and drilling

rig available to start work after this 3-week period. The soil quality evaluation and monitoring well installation and development activities will require approximately 5 weeks to complete.

Following a 2-week period to allow groundwater conditions to stabilize, one round of groundwater elevation measurements concurrent with the initial groundwater sampling and analysis event will be completed in 1 week. Following completion of the first round of groundwater sampling, a subsequent round of groundwater sampling and analysis will occur 3 to 6 months later. The timing of the second sampling will consider potential water quality differences due to seasonality and, therefore, the specific month of sampling will be dependent on the time of year the fieldwork is performed. The project schedule presented in Figure 16 assumes the second sampling will occur 6 months after the initial sampling. Analytical results are assumed to be received within 5 weeks of sample submittal to the laboratory.

Following receipt of the analytical data, GCC will prepare a RFI report summarizing the findings. The report will include a risk assessment. The report will require 12 weeks to complete, at which time it will be submitted to the USEPA.

If during the initial data evaluation period data gaps are identified, a summary report and proposed Phase II Scope of Work will be submitted within the same time frame as the draft RFI report for the USEPA's review and approval.

4.8 Project Staffing

A project organization chart for the RFI activities is presented in Figure 17. Resumes for key project personnel identified are provided in Appendix I.

Tables

Table 4-1
Rationale for Soil Sampling at Solid Waste Management Units, and Areas of Concern
Delaware Valley Works Facility
Claymont, Delaware

SWMU/ AOC ID	Name	Soil Sampling and Analysis	Rationale
SWMU 1	Phosphoric Acid Storage Pond (North Pond)	Yes	Surface soils associated with the SWMU are uncovered; therefore, the soil-to-industrial worker pathway will be evaluated.
SWMU 2	Phosphoric Acid Storage Pond (South Pond)	No	SWMU is covered with concrete and asphalt; therefore, there is no exposure pathway from soil to industrial worker.
SWMU 3	Red Mud Slurry Pond A	No[(1)]	SWMU is covered with asphalt; therefore, there is no exposure pathway from soil to the industrial worker. Also, there are no documented releases.
SWMU 4	Red Mud Slurry Pond B	No	SWMU is covered with asphalt; therefore, there is no exposure pathway from soil to the industrial worker. Also, there are no documented releases.
SWMU 5	Spar Building Storage Area	No[(2)]	SWMU is thought to be covered with asphalt; therefore, there may be no exposure pathway from soil to the industrial worker. Also, there are no documented releases.
SWMU 6	Drum Storage, South Treatment Plant	No[(1)]	SWMU is covered with concrete; therefore, there is no exposure pathway from soil to the industrial worker. Also, there are no documented releases.
SWMU 7	Effluent Clarifier Tank	No	Tank has a concrete foundation and surrounding area is covered with asphalt. No documented releases.
SWMU 8	Alum Clarifier Tank	No	Tank has a concrete foundation and surrounding area covered with asphalt. No documented releases.
SWMU 10	South Waste Treatment Storage Pad	No[(2)]	SWMU is thought to be covered with concrete; therefore, there may be no exposure pathway from soil to the industrial worker. Also, there are no documented releases.
SWMU 11	Waste Oil Storage AST	No	SWMU consists of a fiberglass AST surrounded by concrete secondary containment. There are no documented releases.

Table 4-1
Rationale for Soil Sampling at Solid Waste Management Units, and Areas of Concern
Delaware Valley Works Facility
Claymont, Delaware

SWMU/ AOC ID	Name	Soil Sampling and Analysis	Rationale
SWMU 12	Waste Oil Storage UST	No	SWMU is covered with concrete; therefore, there is no exposure pathway from soil to the industrial worker. Also, there are no documented releases.
SWMU 16	Past Landfill - Area IV	Yes	Surface soils associated with the SWMU are uncovered; therefore, the soil-to-industrial worker pathway will be evaluated.
SWMU 21	Past Landfill - Area IX	Yes	Soils associated with the SWMU are partially uncovered; the soil-to-industrial worker pathway will be evaluated. Previous investigations have not defined the lateral extent of impacted soils associated with the SWMU.
SWMU 22	Past Landfill - Area X	Yes	Soils associated with the SWMU are partially uncovered; the soil-to-industrial worker pathway will be evaluated. Previous investigations have not defined the lateral extent of impacted soils associated with the SWMU.
SWMU 23	Past Landfill - Area XI	Yes	Surface soils associated with the SWMU are uncovered; therefore, the soil-to-industrial worker pathway will be evaluated.
SWMU 24	RCRA Storage Area	No	SWMU is covered with concrete; therefore, there is no exposure pathway from soil to the industrial worker. Also, there are no documented releases.
SWMU 25	Sulfuric/Oxalic Storages	No	Aboveground tanks are no longer present. The area where they were is now covered with asphalt; therefore, there is no exposure pathway for soil-to-industrial worker. Also, there are no documented releases.
SWMU 26	South Waste Treatment Plant	No	SWMU is covered with concrete and asphalt; therefore, there is no exposure pathway from soil-to-industrial worker. Also, there are no documented releases.
SWMU 27	Environmental Protection Station - North	Yes	Surface soils associated with the SWMU are uncovered; therefore, the soil-to-industrial worker pathway will be evaluated.
SWMU 28	Hypo Muds Accumulation	Yes	Surface soils associated with the SWMU are uncovered; therefore, the soil-to-industrial worker pathway will be evaluated.

Table 4-1
Rationale for Soil Sampling at Solid Waste Management Units, and Areas of Concern
Delaware Valley Works Facility
Claymont, Delaware

SWMU/ AOC ID	Name	Soil Sampling and Analysis	Rationale
SWMU 30	East and West Lagoons	Yes	Soils associated with the SWMU are partially uncovered; therefore, the soil-to-industrial worker pathway will be evaluated.
SWMU 31	Spent Acid Lagoon	No	Appropriate soil sampling and analysis activities were conducted in association with DNREC consent order.
SWMU 32	Former UST Area	No	Surface soils associated with the SWMU are covered with asphalt; therefore, there is no exposure pathway from soil to the industrial worker. Appropriate soil and groundwater sampling and analysis activities were conducted in association with closure of the USTs.
AOC 1	Tank 15 Spill Area	Yes	Surface soils associated with the SWMU are uncovered; therefore, the soil-to-industrial worker pathway will be evaluated.
AOC 2	Acid Spill Area	No	Spill area is currently covered with concrete. No pathway from soil-to-industrial worker exists.
AOC 3	Pesticide Investigation/ Remediation Area	Yes	Several areas on the north plant have soils that are uncovered; therefore, the soil-to-industrial worker pathway will be evaluated. These areas represent potential exposure pathways between soil and the industrial worker.
AOC 4	Conrail Fuel Spill Area	Yes	Surface soils associated with the SWMU are uncovered; therefore, the soil-to-industrial worker pathway will be evaluated.

Notes:
(1)If it is determined a portion of this SWMU is uncovered, it will be covered with asphalt in the immediate future.
(2)In the event the SWMUs are not found to be completely covered, soil sampling will be performed to evaluate the soil-to-industrial worker exposure pathway.

Table 4-2
Summary of Work to Be Performed
Delaware Valley Works Facility
Claymont, Delaware

SWMU Identification	Scope of Work	Data Collection Objectives
SWMU 1 – Phosphoric Acid Storage Pond (North Pond)	• Collect 2 surface soil samples (0- to 6-inches depth interval) and analyze them for Appendix IX metals and pH.	• Characterize the soil-to-industrial worker exposure pathway.
SWMU 3 – Red Mud Slurry Pond A	• Confirm entire area is covered with asphalt and asphalt is in good condition. • If area(s) are not covered with asphalt, cover the entire area with asphalt.	• Confirm current extent of asphalt cover.
SWMU 5 – Spar Building Storage Area	• Confirm area is covered with asphalt and asphalt is in good condition. • If area(s) is not covered with asphalt, collect up to 4 surface soil samples (0- to 6-inches depth interval) from uncovered areas and analyze for Appendix IX metals, VOCs, SVOCs, and pH.	• If necessary, characterize the soil-to-industrial worker exposure pathway.
SWMU 6 – South Treatment Plant, Drum Storage	• Confirm entire area is covered with asphalt/concrete and cover is in good condition. • If area(s) are not covered, cover unpaved areas with asphalt.	• Confirm current extent of asphalt cover.
SWMU 10 – South Waste Treatment Storage Pad	• Confirm existence of concrete pad beneath the existing gravel. • If there is no concrete pad beneath the gravel, collect up to 4 surface soil samples (0- to 6-inch depth interval) from uncovered areas and analyze them for Appendix IX metals and pH.	• If necessary, characterize the soil-to-industrial worker exposure pathway.

Table 4-2
Summary of Work to Be Performed
Delaware Works Facility
Claymont, Delaware

SWMU Identification	Scope of Work	Data Collection Objectives
SWMU 16 – Past Landfill – Area IV	• Collect and analyze 1 surface soil sample (0- to 6-inch depth interval) from each of the two landfills. • Collect and analyze 7 surface soil samples (0- to 6-inch depth interval) adjacent to each of the two landfills. • Analyze soil samples for Appendix IX VOCs, SVOCs, organo-chlorine pesticides, organo-phophorus pesticides, herbicides, metals, cyanide and pH. • Advance perimeter test pits to a depth of 4 feet to physically evaluate soils.	• Characterize the soil-to-industrial worker exposure pathway. • Confirm the location and lateral extent of the landfill and potentially impacted soil.
SWMU 21 – Past Landfill – Area IX SWMU 22 – Past Landfill – Area X SWMU 30 – East and West Lagoons	• Collect 11 surface soil samples (0- to 6-inch depth interval) at 100-foot centers around the group of SWMUs. The samples will initially be collected approximately 25 feet beyond the previous soil sample locations associated with the monitoring well network at the Facility. • Analyze soil samples for Appendix IX VOCs, SVOCs, organo-chlorine pesticides, organo-phosphorus pesticides, herbicides, metals, cyanide and pH.	• Characterize the soil-to-industrial worker pathway. • Characterize the lateral extent of potentially impacted soil, associated with the landfills.
SWMU 27 – Environmental Protection Area – North	• Collect 5 surface soil samples (0- to 6-depth interval from around the aboveground storage tanks and analyze then for Appendix IX VOCs, SVOCs, organo-chlorine pesticides, herbicides, metals, cyanide, and pH.	• Characterize the soil-to-industrial worker pathway.

Table 4-2
Summary of Work to Be Performed
Delaware Works Facility
Claymont, Delaware

SWMU Identification	Scope of Work	Data Collection Objectives
SWMU 28 – Hypo Muds Accumulation	• Collect 3 surface soil samples (0- to 6-inch depth interval) from each of the two areas and analyze them for Appendix IX metals and pH.	• Characterize the soil-to-industrial worker exposure pathway.
AOC 1 – Tank 15 Spill Area	• Collect 2 surface soil samples (0- to 2 -foot depth interval) from outside the containment area and analyze them for Appendix IX metals and pH.	• Characterize the soil-to-industrial worker exposure pathway.
AOC 3 – Pesticide Investigation/Remediation Areas	• Collect a total of 4 surface soil samples (0- to 6-inch depth interval) from 2 separate locations within the North Plant. • Collect 3 surface soil samples (0- to 6-inch depth interval) from contiguous property north of the North Plant. • Analyze soil samples for Appendix IX organo-chlorine pesticides, organo-phosphorus pesticides, and herbicides. • Inspect GCC property on the North Plant for additional uncovered soil areas near the historical pesticide-impacted surface soils and collected soil samples as necessary.	• Characterize the soil-to-industrial worker exposure pathway. • Characterize the extent of potentially impacted soil associated former pesticide manufacturing activities.
AOC 4 - Conrail Fuel Spill Area	• Collect 2 surface soil samples (0- to 6-inch depth interval) and analyze them for Appendix IX, VOCs, and SVOCs.	• Characterize the soil-to-industrial worker exposure pathway.

Table 4-2
Summary of Work to Be Performed
Delaware Works Facility
Claymont, Delaware

SWMU Identification	Scope of Work	Data Collection Objectives
Groundwater	• Install 17 groundwater monitoring wells to straddle the water table. • Sample and analyze 24 monitoring wells (17 newly installed by GCC and 7 existing wells) and perform one confirmatory sampling and analysis event approx. 3 months after the initial sampling event. • Utilize groundwater data from 4 newly installed wells on Honeywell property on the North Plant. • Possible analytical suite for groundwater samples includes Appendix IX VOCs, SVOCs, organo-chlorine pesticides, organo-phophorus pesticides, herbicides, metals, cyanide, and pH. The analytical suite is well dependent; see Table 4-5 for further information. • Obtain one soil sample from each soil boring at the water table and analyze for soil organic content. • Obtain depth to groundwater measurements from each of the 32 monitoring wells (existing and newly-installed) during both groundwater sampling events.	• Obtain Facility-wide groundwater quality for shallow groundwater. • Evaluate the groundwater to surface water exposure pathway. • Determine groundwater flow direction of shallow groundwater.

Table 4-3
Analytical Methods and Quality Assurance Summary
Soil Sampling Program
Delaware Valley Works Facility
Claymont, Delaware

Required Constituent Analysis	Analytical Method[(1)]	No. of Samples	No. of Duplicates	No. of Rinsate Blanks	No. of Trip Blanks
Appendix IX VOCs	8260B	35	3	1 per day	1 per batch shipment
Appendix IX SVOCs	8270C	35	3	1 per day	-
Appendix IX Organo-chlorine pesticides (includes Kepone)	8081A/8082	36	3	1 per day	-
Appendix IX Organo-phosphorus pesticides	8141A	36	3	1 per day	-
Appendix IX Herbicides	8151A	36	3	1 per day	-
Appendix IX Metals	6010B	47	3	1 per day	-
Mercury	7471A	47	2	1 per day	-
Cyanide	9012A	29	2	1 per day	-
pH	9040C	47	3	1 per day	-

Notes:
[(1)]All analytical methods are SW-846.

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Analytical Methods

Table 4-4
Proposed Groundwater Monitoring Locations
Delaware Works Facility
Claymont, Delaware Facility

Well ID	Well Location	GCG's Data Objective	Comments
B-1	Along Delaware River	Evaluate current water quality conditions associated with the former acid spill area (AOC 2) and establish facility wide flow conditions	Evaluate potential impacts from SWMUs 1,2,6,7,8,26 and AOC 2.
B-2 and B-2D	Along Delaware River	Evaluate possible in-stream concentrations due to groundwater discharge and their potential impact on human health and ecological receptors.	Evaluate potential impacts from SWMUs 1,2,6,7,8,26 and AOC 2.
B-3	Along Delaware River	Evaluate current water quality conditions associated with the former acid spill area (AOC 2) and establish facility wide flow conditions	Evaluate potential impacts from SWMUs 1,2,6,7,8,26 and AOC 2.
B-4	Along Delaware River	Evaluate current water quality conditions associated with the former acid spill area (AOC 2) and establish facility wide flow conditions	Evaluate potential impacts from SWMUs 1,2,6,7,8,26 and AOC 2.
B-5 and B-5D	Along Delaware River	Evaluate current water quality conditions associated with the former acid spill area (AOC 2) and establish facility wide flow conditions	Evaluate potential impacts from SWMUs 1,2,6,7,8,26 and AOC 2.
SAL-1	Northwestern edge of the South Plant	Establish facility-wide groundwater flow conditions.	Historical groundwater quality will be used during data evaluation.
SAL-3	Northwestern edge of the South Plant	Establish facility-wide groundwater flow conditions.	Historical groundwater quality will be used during data evaluation.
SAL-4	Northwestern edge of the South Plant	Establish facility-wide groundwater flow conditions.	Historical groundwater quality will be used during data evaluation.

Well ID	Well Location	GCC's Data Objective	Comments
EWL-5	Western portion of North Plant	Establish facility-wide groundwater flow conditions.	Historical groundwater quality will be used during data evaluation.
EWL-6	Western portion of North Plant	Establish facility-wide groundwater flow conditions.	Historical groundwater quality will be used during data evaluation.
EWL-7	Western portion of North Plant	Establish facility-wide groundwater flow conditions.	Historical groundwater quality will be used during data evaluation.
EWL-8	Western portion of North Plant	Establish facility-wide groundwater flow conditions.	Historical groundwater quality will be used during data evaluation.
EWL-9	Western portion of North Plant	Establish facility-wide groundwater flow conditions.	Historical groundwater quality will be used during data evaluation.
MW-1	Southeastern edge of North Plant	Establish facility-wide groundwater flow conditions and evaluate potential impacts from sources north/northeast of the facility.	Evaluate potential impacts from SWMU's 16 and 24.
MW-2	Southwestern edge of North Plant	Evaluate possible in-stream concentrations due to groundwater discharge and their potential impact on human health and ecological receptors.	Evaluate potential impacts from SWMU's 21, 22, 27 and 30 and potential impact on Naamans Creek.
MW-3	Northern edge of South Plant	Establish facility-wide groundwater flow conditions and evaluate future groundwater quality conditions at perimeter wells.	Evaluate potential impacts from individual SWMUs on the North Plant.
MW-4	Northeastern edge of South Plant	Establish facility-wide groundwater flow conditions and evaluate potential impacts from sources north/northeast of the facility.	None
MW-5	Northwestern edge of the South Plant	Evaluate possible in-stream concentrations due to groundwater discharge and their potential impact on human health and ecological receptors.	Evaluate potential impacts from SWMU 31.
MW-6	Central portion of the South Plant	Establish facility-wide groundwater flow conditions and evaluate future groundwater quality conditions at perimeter wells.	Evaluate potential impacts from SWMU 28.

Well ID	Well Location	GCG's Data Objective	Comments
MW-7	West central portion of South Plant	Evaluate possible in-stream concentrations due to groundwater discharge and their potential impact on human health and ecological receptors.	Evaluate potential impacts from AOC 1 and SWMU's 3, 4, and 32.
MW-8	Along Delaware River	Evaluate possible in-stream concentrations due to groundwater discharge and their potential impact on human health and ecological receptors.	Evaluate potential impacts from SWMUs 1, 2, 6, 7, 8, and 26.
MW-9	Along Delaware River	Evaluate possible in-stream concentrations due to groundwater discharge and their potential impact on human health and ecological receptors.	Evaluate potential impacts from SWMUs 6, 10 and 26.
MW-10	Along Delaware River	Evaluate possible in-stream concentrations due to groundwater discharge and their potential impact on human health and ecological receptors.	Evaluate potential impacts from SWMU 10.
MW-11	Along Delaware River	Evaluate possible in-stream concentrations due to groundwater discharge and their potential impact on human health and ecological receptors.	Evaluate potential impacts from SWMUs 3, 4, 32, and AOC 1.
MW-12	Northwestern corner of the South Plant	Evaluate possible in-stream concentrations due to groundwater discharge and their potential impact on human health and ecological receptors.	Evaluate potential impacts from SWMU's 12, 21, 22, 23, 25 and 30.
MW-13	East central portion of the South Plant	Establish facility-wide groundwater flow conditions and evaluate potential impacts from off-site sources to the northeast.	None
MW-14	Central portion of South Plant	Establish facility-wide groundwater flow conditions and evaluate future groundwater quality conditions at perimeter wells.	Evaluate potential impacts from SWMU 32.
MW-15	West central portion of South Plant	Evaluate possible in-stream concentrations due to groundwater	Evaluate potential impacts from SWMUs 3 and 4.

Well ID	Well Location	GCG's Data Objective	Comments
		discharge and their potential impact on human health and ecological receptors.	
MW-16	Eastern portion of North Plant	Establish facility-wide groundwater flow conditions and evaluate future groundwater quality conditions at perimeter wells.	Evaluate potential impacts from SWMUs 22, 23 and 25.
MW-17	Western Portion of North Plant	Establish facility-wide groundwater flow conditions and evaluate future groundwater quality conditions at perimeter wells.	Evaluate potential impacts from SWMU's 16 and 24.
Honeywell Property			
MW--H	Northern edge of North Plant	Establish facility-wide groundwater quality and flow conditions. Evaluate potential impacts from off-site sources to the north.	None.
MW--H	Northeastern Edge of North Plant	Establish facility-wide groundwater quality and flow conditions. Evaluate potential impacts from off-site sources to the northeast.	None.
MW-H	Westcentral portion of North Plant	Establish facility-wide groundwater quality and flow conditions.	None.
MW-H	Northwestern edge of North Plant	Establish facility-wide groundwater quality and flow conditions. Evaluate potential impacts from off-site sources to the northwest.	None.

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Table 4-5
Analytical Methods and Quality Assurance Summary
Groundwater Sampling Program
Delaware Valley Works Facility
Claymont, Delaware

Required Constituent Analysis	Analytical Method[1]	No. of Samples per Round	No. of Duplicates	No. of Rinsate Blanks	No. of Trip Blanks
Appendix IX VOCs	8260B	18	1	1 per day	1 per batch shipment
Appendix IX SVOCs	8270C	18	1	1 per day	-
Appendix IX Organo-chlorine pesticides (includes Kepone)	8081A/8082	18/2	1	1 per day	-
Appendix IX Organo-phosphorus pesticides	8141A	18	1	1 per day	-
Appendix IX Herbicides	8151A	18	1	1 per day	-
Appendix IX Metals	6010B	24	1	1 per day	-
Mercury	7471A	24	1	1 per day	-
Cyanide	9012A	18	1	1 per day	-
pH	9040B	24	1	-	-

Notes:
[1]All analytical methods are SW-846.

General Notes:
1. Monitoring wells B-1, B-3, B-4, B-5 and B-5D will be sampled for Metals and pH for one sampling round only.
2. Monitoring wells B-2, B-2D, and MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16, and MW-17 will be sampled for all constituents listed for two sampling rounds.

5.0 Task V – Investigation Analysis

The information generated during RFI activities will be evaluated using the criteria presented in this section. The data will be evaluated and the Final Risk Assessment will be completed. Data analysis will be initiated immediately upon receipt of data generated during the RFI. The data will be compared with applicable screening values (e.g., USEPA Region III industrial and residential risk-based concentrations) to ensure that the investigation data are sufficient to meet the scope of work objectives, to evaluate human health and environmental risks, and to support a CMS, if required. If early review of the data indicate additional data are needed, GCC will notify the USEPA and will prepare and implement additional scopes of work prior to completion of the RFI.

Prior to using the data, data validation will be completed. For the scope of work outlined in Chapter 4.0, 100 percent of the data collected will be validated to IM1 level for inorganic constituents and M2 level for organic compounds. If additional RFI phases are necessary, a RFI Work Plan addendum will specifically identify the percentage of validation. Following compilation or data validation, the data will be managed and summarized in a usable format for data manipulation in accordance with the Data Management Plan. Tables will be created to exhibit the analytical data and define the type, degree, and extent of COPIs. Additionally, hydrologic and geologic data will be evaluated and geologic cross sections, groundwater contour maps, etc. will be developed. The information generated from this task will be presented in the RFI report. The following sections present a summary of the human health risk assessment (Section 5.1) and the ecological risk evaluation (Section 5.2).

5.1 Human Health Risk Assessment

A human health risk assessment for the industrial worker will be conducted using the most recent available guidance documents from the USEPA or alternative methods approved by the USEPA coordinator. Direct contact, ingestion and inhalation pathways will be considered.

The risk assessment will consist of four general sections, as follows: (1) Data Evaluation; (2) Toxicity Assessment; (3) Exposure Assessment; and (4) Risk Characterization. Each of these components is described in the following paragraphs.

The Data Evaluation section will identify and select COPIs that are above applicable screening values.. Chemical concentrations, chemical release and environmental transport mechanisms, exposure routes, and toxicity will be used to evaluate Facility-specific COPIs and to define the Facility-associated risks. This

section will contain information on the chemicals detected in one or more samples, the ranges of detected concentrations and detection limits for nondetected samples, the chemical concentration in background samples, and the values against which the detected concentrations are screened. Soil samples may be grouped into exposure areas if that designation makes sense. This will serve to help evaluate potential "hot spots" separate from the rest of the Facility.

The following criteria will be used to select COPIs:

- If a chemical is quantified at a maximum concentration that exceeds the risk-based screening value, the chemical will be selected as a COPI.
- Tentatively identified compounds will be selected as COPIs if they are known, specific compounds with available toxicity data, not column bleed products such as siloxane, and not identified specifically in any other analytical fraction for the sample. Specifically identified tentatively identified compounds that fit the other criteria but do not have published toxicity data will be qualitatively addressed in the uncertainty section.

An evaluation of risk to human health posed by soils will be completed using a cumulative acceptable risk level for an industrial setting. An initial cumulative carcinogenic risk target will be 1×10^{-6}; however, a higher acceptable risk of 1×10^{-4} or 1 x 10-5 will be considered, based on the absence of sensitive human populations and limited number of receptors potentially impacted and their potential infrequent exposure. A hazard index of 0.1 by affected target organ will be used for noncarcinogenic constituents. These goals are based on Facility-specific exposure assumptions that will be consistent with the current, as well as the expected, future land use of the property. Both the current and future land use of the property is industrial.

Groundwater beneath the Facility does not pose a risk to human health because there is no complete pathway. As such, groundwater will not be addressed further for purposes of a human health risk assessment. Groundwater from the Facility discharges into the Delaware River. The Delaware River is used for some recreational activities. However, this exposure pathway is not likely to pose a risk to human health due to infinite dilution that would result from subsequent mixing. Nevertheless, this potential pathway will be evaluated during the RFI by using the groundwater data obtained from Facility wells to predict instream concentrations of COPIs. Instream concentrations of COPIs will be developed using the SWLOAD spreadsheet program or other equivalent method. The instream concentrations of COPIs will initially be compared with extremely conservative (health-based) federal and state promulgated ambient water quality criteria (AWQC) protective of human health. Human health AWQC

are derived for the protection of humans consuming water for drinking from the river, as well as humans consuming water and organisms from the river. If these criteria are exceeded, then a Facility-specific surface water recreational criterion will be developed for comparison purposes. Constituents that do not have recommended AWQCs will be included in an evaluation of surface water recreational exposure for the Delaware River by using available toxicity criteria and specific exposure scenario(s). Based upon 1) the distance between GCC's property and Naamans Creek; 2) the fact that other entities own and operate industrial operations on properties that separate GCC and Naamans Creek; and 3) numerous other possible influences on Naamans Creek from upstream sources, GCC believes that it has no obligation to evaluate potential impacts to Naamans Creek. Thus, GCC believes that possible impacts on Naamans Creek via groundwater should be investigated, if at all, by Honeywell or owners of property adjacent to the creek. On-site groundwater data will be used to determine whether constituents of concern are migrating off site at acceptable levels.

5.2 Ecological Risk Evaluation

The evaluation of potential ecological risks will focus on potential impacts of groundwater discharging to the Delaware River. The in-stream concentrations due to groundwater discharge will be modeled using the SWLOAD spreadsheet program or similar modeling program. In-stream concentrations will be calculated based on data from a single well or a series of wells, depending on the data. These values will be initially compared to federal and state promulgated ambient water quality criteria to determine whether there are potential adverse impacts from the Facility on ecological receptors in the Delaware River. For parameters without promulgated water quality criteria, other available surface water benchmarks will be reviewed. If potential adverse impacts are identified during the initial comparison, additional characterization or modeling techniques may be recommended to further evaluate the results. Based upon 1) the distance between GCC's property and Naamans Creek; 2) the fact that other entities own and operate industrial operations on properties that separate GCC and Naamans Creek; and 3) numerous other possible influences on Naamans Creek from upstream sources, GCC believes that it has no obligation to evaluate potential impacts to Naamans Creek. Thus, GCC believes that possible impacts on Naamans Creek via groundwater should be investigated, if at all, by Honeywell or owners of property adjacent to the creek. On-site groundwater data will be used to determine whether constituents of concern are migrating off site at acceptable levels.